A STUDY OF INCIDENCE OF COMPLICATIONS IN THYROID SURGERY

Dissertation submitted in

fulfillment of the regulations of

M.S DEGREE EXAMINATION

GENERAL SURGERY

BATCH - I

DEPARTMENT OF GENERAL SURGERY

STANLEY MEDICAL COLLEGE & HOSPITAL

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THE TAMIL NADU DR.M.G.R. MEDICAL UNIVERSITY

CHENNAI

SEPTEMBER - 2006

ACKNOWLEDGEMENT

I thank **Dr.M. VASANTHA,** the Dean of Government Stanley Medical College and Hospital, Chennai for permitting me to use all the resources at her disposal for my dissertation work.

I thank **Prof.D.R. GUNASEKARAN M.S, FICS,** the Professor and Head of the Department of General Surgery, Stanley Medical College and Hospital, Chennai, for giving me the opportunity to conduct this study.

I would like to acknowledge the help rendered by my unit Chief **Prof.MUSTAQ AHAMED KHAN M.S.** for the guidance throughout the course of this study.

I would like to acknowledge the help rendered by **Dr.R.KUMAR M.S. Dr.R.RAMESH BABU M.S.** and **Dr. M.GUNASEKARAN M.S** for their help in this study.

I am also thankful to my co-post graduates for their help.

Finally I wish to offer special appreciation to my patients for their sustained co-operation in connection with this dissertation work.

CONTENTS

CERTIFICATE

This is to certify that this dissertation on **"INCIDENCE OF COMPLICATIONS IN THYROID SURGERY",** presented herein by Dr.S.Kabilan , is a original work done in the department of General Surgery , Government Stanley Medical college and Hospital, Chennai in fulfillment of regulations of the The Tamilnadu Dr.M.G.R Medical Univerity, Chennai for the award of M.S(General Surgery), under Guidance and supervision during the academic period 2003-2006.

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DECLARATION

I, Dr.S.Kabilan, solemnly declare that this dissertation, titled **"INCIDENCE OF COMPLICATIONS IN THYROID SURGERY"** is a bonafide record work done by me in the Department of General Surgery, Government Stanley Medical College and hospital, Chennai under the guidance of DR.D.R.GUNASEKARAN .M.S F.I.C.S. professor and Head of the Department of Surgery, Govt. Stanley medical College and Hospital,
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This dissertation is submitted to The Tamil Nadu Dr.M.G.R Medical University, Chennai in partial fulfillment of regulations for the award of M.S(General Surgery) examinations to be held on September 2006.

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INTRODUCTION

Thyroid pathology is a common condition which surgeons encounter in the outpatient room.

This is an interesting study which assess the techniques adapted and the complications rates seen with them.

Knowing the incidence of complications in any surgical procedure helps us in 2 ways.

1. Enables us to inform the patient about their queries.

2. Evaluate our performances especially when there are established norms on the extent of complications.

AIMS AND OBJECTIVES

1. To know the incidence of complications in thyroidectomy.

2. To identity the relation between the type of procedure and the risk of complication.

3. Gender incidence.

4. Age Incidence.

REVIEW OF LITERATURE

THYROIDECTOMY

"THE EXTIRPATION OF THE THYROID GLAND FOR GOITRE

TYPIFIES PERHAPS BETTER THAN ANY OTHER OPERATION THE

SUPREME TRIUMPH OF THE SURGEON'S ART ."

-HALSTEAD , 1920.

Nomenclature of thyroidectomy is varied. The name of the procedure varies according to the extent of resection.Accordingly the various types of thyroidectomy can be grouped as follows:

1. PARTIAL LOBECTOMY :A portion of a lobe is removed.

2. LOBECTOMY : one of the lobes is removed entirely.

3. HEMITHYROIDECTOMY:one of the lobes and the isthmus is removed.

4. SUB-TOTAL THYROIDECTOMY: a portion of a lobe is left either on one side or both sides, called accordingly as monolateral or bilateral remnant .

5. NEAR TOTAL THYROIDECTOMY: One lobe and isthmus are removed and less than 10% of the other lobe is left behind, generally 2gm or less.

6. TOTAL THYROIDECTOMY : Both lobes and isthmus is removed.

7. ISTHMUSECTOMY: Isthmus alone is removed as biopsy procedure or as a palliative procedure to relieve obstruction in cases of anaplastic carcinoma or

lymphoma of thyroid.

INITIAL STEPS:

Thyrotoxic patients are rendered euthyroid before surgery Patients with medullary carcinoma of Thyroid are evaluated for pheochromocytoma. Close communication with the anaesthetist is important in goiters producing tracheal compression or causing laryngomalacia.

POSITIONING THE PATIENT:

Patient Is given a 10-20 degree of head up to prevent per-op bleed.Neck is extended with sandbags between the shoulders and the is supported with a ring.

ANAESTHESIA:

General anaesthesia with endo-tracheal tube is Given.No paralytic agent is used when RLN monitoring and stimulation are planned.

INCISION:

A curvilinear collar type incision is used 2 finger breaths above the sternal notch placed over a skin crease if one is available.

FLAPS:

A sub-platysmal flaps are raised superiorly upto the thyroid notch and inferiorly upto the clavicles.Anterior jugular veins over the strap muscles are left as the flaps are raised.

MIDLINE:

Next is to open the investing layer of deep Cervical fascia in the mid line between the medial edges of the sternothyroid muscle. Tracheal cartilage is considered as the landmark for midline orientation throughout the case.while opening the midline inferior to the isthmus care must be taken not to injure the right and left inferior thyroid veins,which may blend sometimes to form a plexus called as *plexus thyroideus impar*.The surgeon must also watch for the thyroid ima artery,occurs in 1.5 – 12 % of cases.

STRAP MUSCLES:

The strap muscles must be seperated off the thyroid capsule to deliver the lobe.Outer layer of muscles are the sternohyoid and the omohyoid.The omohyoid is important because nodal disease can track down from the central visceral compartment to the lateral neck chain along the omohyoid. The inner strap muscle is the sternothyroid.The medial edge of the sternothyroid lies laterally, so the sternohyoid must be retracted to seen the muscle.The midline fascial interval between the medial edges of the sternohyoid is called as the *linea alba.* typically some fibrotic reaction can be encountered as a result of FNAC as the sternohyoid is dissected off the anterior surface of the thyroid gland.If a plane cannot be created with ease then malignant infiltration of the strap muscle must be considered. In such cases the strap muscle must not be separated from the lobe but rather resected along with the gland.

If adequate exposture is not available then the stap muscles can be cut without any hesitation.This results in no loss of function or cosmetic concern.superior division of the strap muscle is best to get the maximum exposture of the gland.During strap muscle transaction the myst be kept bloodless.before transection lateral border of the strap muscle must be identified to prevent injury to the carotids and jugular vein, since the carotid sheath is directly adherent to the muscle.

Occasionally small bridging vessels extend from the true capsule of thyroid gland to the undersurface of the strap muscle.These vessels are best identified individually and cauterized.They can cause troublesome bleeding if the interval between the strap muscle and the thyroid capsule is dissected blindly digitally.

True thyroid capsule is tightly adherent to the thyroid parenchyma and is continuous with the fibrous septa that divide the thyroid parenchyma into lobules.The true capsule is extensively ramified by large capsular vessels,which can cause significant bleeding if the gland is handled aggressively during retraction.

Pyramidal lobe represents the inferior most portion of the embryological remnant of the thyroglossal duct tract and is present in 30-40% of individuals.Typically this arises from the middle of the isthmus but can arise even more laterally ,even from the right or left upper poles.The relatively dense fascia over the cricoid cartilage can obscure the pyramidal lobe. One should check the appearance of any transected tissue in this interval just superior to the isthmus,because the cut edge of thyroid tissue representing the isthmus can easily be recognized.The pyramidal lobe extends to a varying degree superioly, occasionally to the hyoid bone.

LATERAL THYROID DISSECTION:

Once the strap muscles are retracted or Divided , a round of preliminary either blunt or sharp dissection lateral to the thyroid is performed to mobilize the lobe preliminarily and to identify the middle thyroid vein.The lateral thyroid region is opened by the division of the middle thyroid vein. This vein should be doubly tied laterally , because it is a direct tributary of the Internal jugular vein . The middle thyroid vein runs without arterial complement.

The lateral thyroid region is opened, after Division of the middle thyroid vein, by lateral retraction of the strap muscle and by medial retraction of the thyroid over the laryngotracheal complex.Kocher referred to this maneuver as " medial dislocation of the goiter".The combination of these maneuvers successfully opens the lateral thyroid region and is essential for full exposture.

In patient with unifocal or unilobar lesions, the Contralateral lobe is explored first.The is first inspected and very carefully palpated. If no abnormality is noted then the contralateral lobe is left alone and attention is focused to the ipsilateral side.

RECURRENT LARYNGEAL NERVE:

There are several approaches to finding and Carefully preserving the RLN . The RLN is identified by either of the approaches. The approaches used for identification are,

1. Lateral approach.
2. Inferior approach.
3. superior approach.

Lateral approach

Here the RLN is searched in the tracheo-esophageal groove and the inferior thyroid artery and RLN _transection.

Inferior approach

Here the nerve is searched in the RLN triangle described by Lore.

The margins of the triangle are,

1. Apex : Thorasic inlet.
2. Lateral margin : Retracted sternothyroid muscle
    1. Medially : Trachea

SUPERIOR APPROACH

In this approach the nerve is searched near its termination. This is the most important part of the nerve, because most of the injury occur in this part.Most common site of injury "is in the last 2 cm" of its course. The anatomical landmarks for identification of RLN are,

1. Between the 2 leaves of Berry's ligament.
2. 0.5-1cm below the inferior cornu of the thyroid cartilage.
3. Its entry point into the cricopharyngeous muscle.

Among the above approaches the most commonly sought site is the Lateral Thyroid Region.

PARATHYROIDS

After the nerve it's the parathyroid glands that takes the place of importance. Superior and inferior parathyroids and their must be preserved to avoid post-operative hypocalcemia.

Superior parathyroids are more constant in position most Commonly lying at the level of the crico-thyroid articulation.

Inferior parathyroids are more variable in position, but most commonly lying at the level of the inferior pole of the thyroid gland.

Vascularity to the gland is preserved by medial ligation of the inferior thyroid artery branches close to the capsule of the thyroid gland.

SUPERIOR VERSUS INFERIOR POLE

Some prefer to ligate the superior pole first , others prefer to do last.The advantage of ligating the inferior pole first is the greater mobility of the gland enables the urgeon to exert satisfactory traction when ligating the superior pedicle . Superior pedicle must be ligated branch wise and if possible to spare the parathyroid branch given by the descending branch of the superior thyroid artery.

FINAL STEPS

Lobectomy specimen is sent for frozen section and results awaited before proceeding.

Specimen is inspected for parathyroids, if present they must be implanted in the sternomastoid muscle pockets after mincing them into 1mm particles.

The central and lateral compartment,especially the omohyoid muscle is inspected for lymph nodes.

Parathyroids are eamined for colour change and intactness of its vascular pedicle.Colour change is not a reliable sign of vacularity.

Haemostasis is checked after removing the sand bag and correcting the head tilt.anaesthetist may be casked to simulate a valsalva maneuver to help identify the bleeding points.

If the strap muscles were cut they need not be Sutured.The midline must be closed.

Drain is not usually kept.it is usuall brought out through the wound.it is removed the next day morning.

Skin is approximated either by simple interrupted or Subcuticular sutures ,after approximating the platysma.

COMPLICATIONS

The complications commonly seen in thyroid surgery are,

1. Haemorrage
2. Recurrent laryngeal nerve paralysis.
3. Superior laryngeal nerve paralysis.
4. Hypo-Parathyroidism
5. Thyrotoxic storm
6. Wound infection
7. Hypertrophic scar (or) Keloid.

Hypothyroidism is an eventual complication of thyroid removal and so not included as a surgical complication in study.

HAEMORRAGE

Haemorrage in thyroid surgery can be

1. Primary Haemorrage

2. Reactionary haemorrage.

Primary haemarrage occurs on the operation table associated especially with highly vascular gland as in toxic nodular goiter. Pre- O.P preparation with lugols iodine reduces the incidence of this problem.

More important is the reactionary haemorrhage that is noticed in the immediate post-operative period. It is due to slippage of ligature (or) dislodgement of clot (or) unnoticed venous bleed.

In this setting it becomes life threatening. Because it develops deep to the fascia and forms a tension haematoma compressing the trachea causing respiratory obstruction. As an emergency measure the wound must be opened in the ward to relieve the tension.

Most of the bleeding is of venous origin. Venous bleed may not be obvious on the operating table because of negative venous pressure, head up position and neck extension adopted during surgery.

To prevent this problem the haemastasis is verified after removing the sand bag between this shoulders. The anaesthetist may be asked to simulate a valsalva manuver to raise the intra-pulmonary pressure making the venous bleed obvious.

RECURRENT LARYNGEAL NERVE PARALYSIS

This is the most important complications of thyroid surgery. Because it has the potential to affect the social life of the patient. This is especially important if the person is a singer (or) teacher by profession.

It is an axiom in thyroid surgery that the RLN must be visualized before cutting (or) cauterizing any structure in neck. It has been shown in studies that RLN injury is less in cases where the nerve was specifically identified before proceeding.

The course of right and left side nerves is a bit different. On the left side the nerve winds around the arch of aorta hence it lies more medially, whereas on the right side the nerve winds around the right sub-claim artery hence it has a more oblique course and more susceptible to injury.

Incidence of transient paralysis is 3% recovery occurs and remains in 3 weeks to 3 months - Bailey and Love.

Permanent RLN injury has been reported to be 1-2% in expert hands - Randolph.

Recurrent laryngeal nerve injury becomes important by the fact that "3/4th of the litigation problem in surgical endocrinology is due to recurrent laryngeal nerve involvement" - Kern.

SYMPTOMS OF NERVE INJURY (UNILATERAL NERVE INJURY)

1. Hoarseness of voice

2. Significant dysphagia most noticeably to liquids. Dysphagia is attribute to the paralysis of cricopharyngeus which RLN supplies.

3. Aspiration of saliva and paroxysms of coughing.

Although the unilateral cord paralysis has been found to generate air flow resistance comparable to trachel stenosis of 30%, it is usually not associated with any significant ventilatory disturbance except in elderly persons.

Bilateral vocal card paralysis

"Real surgical calamity" - Lahey.

Bilateral vocal card paralysis is associated with acute airway distress needing emergency tracheotomy. The patient may need permanent tracheostomy (or) glottic widening procedures in future.

Pre-operative laryngoscopy

Symptomatic assessment of vocal cord paralysis is notoriously inaccurate.

It is generally believed that 30-40% of patients with unilateral RLN paralysis are asymptomatic.

This is especially important in thyroid cancers. Because of gradual infiltration of nerve by the malignant cells the cord function is compensated by the opposite vocal cord, so the patient is asymptomatic in 60% of cases (Randoph).

There is another entity known as idiopathic vocal cord paralysis in 8% of persons due to viral infections.

Because of the aforementioned reasons and to protect the surgeon from medico-legal problems and also to take precautions to prevent the injury to other nerve in unilateral paralysis of vocal cord one need not stress the importance of pre-operative laryngoscopy.

RLN Neuroanatomy

RLN contains branchial efferent to the inferior constructor, crico-pharyngeus and all the laryngeal intrisics except the cricothyroid.

Because of the course around the right sub-clavian artery the right RLN enters the neck base more laterally.

The relations and course of the nerve can be conveniently divided into.

1. Inferior part
2. Lateral part
3. Superior part

Inferior part of nerve

The RLN enters the neck emerging from under the common carotid artery. It travels

obliquely towards the tracheo-esophageal groove behind the thyroid gland. The right RLN is more oblique and hence more prone to injury.

The relations of the nerve can be understood by knowing the RLN triangle described by LORE.

Apex : Inferior at the thorasic inlet.

Medial wall : Trachea

Lateral wall : Medial edge of retracted strap muscle

Base : Inferior pole of thyroid gland

Advantage of the nerve identification here is, 1 the presence of safe and clear tissue permitting atraumatic dissection.

2. Another Advantage is the presence of single nerve trunk without branches.

Disadvantage

1. Since long segment of nerve is dissected there is a chance of parathyroid devascularization.

2. Nerve cannot be identified here in non-recurrent cases (1%).

Use

RLN can be searched inferior to the gland for identification. IT is not used toutinely. Usually the nerve is searched laterally, but in revision surgery because of dense scar in this region the inferior approach is prefered.

Lateral part of nerve

Here the nerve lies in the tracheo-oesophageal groove behind the thyroid gland. The tracheo-esophageal groove is well defined on the left side the oesophagus is curved to the left in the neck.

To approach the nerve and to uncover it, first the lobe must be retracted medially over the trachea. To do this the middle thyroid vein and the superior pedicle must be ligated and the thyrothymic ligament cut. This is described as.

"Medial Dislocation of Goitre" - Kocher.

Anatomical landmarks far identifying RLN are.

1. Inferior thyroid artery and RLN intersection.

Inferior thyroid artery is a branch of the thyro-cervical trunk off the 1st part of sub - clavian artery. It comes off the undersurface of the corotid and runs towards the thyroid gland at the mid polar level. If the artery is identified and trace medially towards the gland the RLN will be seen to cross it. The manner of cross over is variable.

50% of cases between the branches.

25% of cases posterior to the artery

25% of cases anterior to artery

2. Tracheo - oesophangeal groove.

3. Vasa nervosum a sheath of blood vessels accompanying the nerve.

4. Tubercle of zuckerkandl.

Tubercle of zuckerkandl is a projection in the lateral lobe of the gland it represents the point of fusion of the ULTIMO BRANCHIAL body.

The tubercle points towards the RLN.

The RLN in routinely searched in this lateral region.

Main disadvantage is in re-surgeries access to this site is limited by dense scar, where a inferior approach is better.

Superior part

This part of the RLN is surgically more important because the RLN is most commonly injured in the last 2 cm of its course. This is because of the close proximity of the nerve to the gland.

"I have noticed in operations of this kind, which I have seen performed by others upon the living and in a number of excisions, which I have myself performed on the dead body, that most of the difficulty in the separation of the tumour has occurred in the region of these ligaments...

This difficulty, I believe, to be a very frequent source of that accident which so commonly occurs in the removal of goiter, I mean the division of the recurrent laryngeal nerve".

- Berry 1888.

Reasons for injury to RLN in this region is.

1. Bleeding

Berrys ligament is a fibro-vascular structure being supplied by a branch of inferior thyroid artery. Separation may cause bleeding and inadvertant clamping (or) diathermy to arrest it may injure the RLN.

2. Close proximity of RLN

Berlin in 1935 studied the relationship of RLN to Berrys ligament. He performed 140 cadavers dissections and 72 surgical dissections. His findings were summarized as follows.

60% of cases RLN runs deep to berreys ligament.

30% of cases between the anterior and posterior leaflets.

10% of cases evenmore anterior to berrys ligament running into the thyroid substance.

It is these set of anatomical concerns that prohibit blind capsular dissection in goiter excision.

Land marks for identifying the nerve in this region are,

1. Inferior horn of the thyroid gland

RLN lies 0.5 - 1cm deep to the inferior horn of the thyroid cartilage.

2. Criopharyngeous muscle entry point.

This entry point is the most constant point in the entire course of nerve.

Nerve identification in this region in technically more challenging in this region. So it is not routinely used.

Non-recurrent RLN

This occurs in 0.5 - 1% of cases on the right side. This is associated with right sub-clavian artery origin from the distal aortic arch.

The subclavian artery is retro-oesophageal and patients may experience dysphagia lusoria.

The non recurrent nerve runs perpendicular to the normal course and lies usually at the level of cricoid cartilage.

Left side non-recurrent nerve occurs only in situs inversus.

Temporary versus permanent paralysis

Temporary paralysis is due to neuropraxia. Permanent paralysis is due to nerve transection.

Neuropraxia recovers in 3 weeks - 3 months. If function is not recovered even after 6 months it is considered to be a permanent paralysis.

Causes of transient paralysis

1. Excessive nerve skeletalization.
2. Neuritis caused by scar tissue
3. Excessive traction on the labe.
4. "A frigate" or "a calorie" paralysis
5. Diathermy heat injury
6. Viral neuritis.

Techniques suggested for preventing RLN injury

1. Identify the nerve before cutting (or) cauterizing any structures.
2. Cover the nerve with luke warm gauge.
3. Avoid using unipolar diathermy where heat dissipation is more.
4. Attention must be placed to non-recurrent laryngeal nerve.
5. Recurrent laryngeal nerve monitoring.

RLN Monitoring

RLN can be monitored continuously both visually and audibly by recording the EMG

(electromyography) of the vocal cord after continuously stimulating the nerve using a probe.

The probes for monitoring are in the endotracheal tube the impulses from it are displayed on an oscilloscope.

Management of RLN Injury

Surgical management must be attempted only after 6 months.

Unilateral paralysis

1. Neuranorraphy

This is done if transection is identified per-operatively, 8`0' (or) 7`0' proline is used for approximating the cut ends.

Synkinesis occurs due to non-selective renervation of the adductor and abductors.

2. Medialization procedures

Otherwise called as thyroplasty type 1. A window is created in the thyroid cartilage and the paralysed cord medialised using silastic (or) goretex implant.

Gelfoam can be used as a temporary procedure for the same procedure. But effective only for 6 months due to absorption of material.

3. Renervation

It is done using ansa - cervicalis neuromuscular implants.

Most commonly used is the medialization procedure otherwise called as REVERSED

WOODMANS operation.

B/L RLN Paralysis

Management options here are,

1. Permanent tracheotomy if no improvement.

2. Glotti widening procedure.

SUPERIOR LARYNGEAL NERVE INJURY

The effect of SLN is missed in most people after surgery. Both clinically and laryngoscopically it is difficulty to pick up. Yet functional consequences can be dramatic in people who depend professionally on their voice. SLN supplies only one muscle - cricothyroid. The main function of cricothyroid muscle is to tense the vocal cord and helps in vocalising high pitched note.

The injury to SLN is so subtle that even Kocher did not specifically mention this nerve in his book, then considered the corner stone of thyroid surgery, documenting his personal experience in more than 3000 thyroidectomies.

The role of the nerve came into light when a most famous soprano, amelita galli - curci was operated in 1935. Her voice lost that high pitched tone. she had to give up singing. Since then the SLN is also known as "THE NERVE OF AMELITA GALLI-CURCI".

Neuro - anatomy

SLN is one of the first branches of the vagus. It is given off 4 cm above the carotid bifurcation. It enter the larynx coming behind the carotids. It gives off the internal branch and descends down to supply the crico-thyroid muscle in close relation to the superior thyroid artery. This is where the importance of the nerve lies.

It leaves the superior thyroid artery some distance from the superior pole. Hence it is generally considered safe to ligate the pedicle close to the superior pole.

The nerve is supposed to lie in the sterno-thyroid laryngeal triangle. The margins off the triangle are,

Base : Superior pole of thyroid

Laterally : Retracted medial margin of sterno-thyroid

Medially : Cricothyroid and inferior constrictor.

Randolph in 1992 proposed the following anatomical classification of SLN based on its relationship to superior thyroid vessels and superior pole of thyroid.

Type 1

(60%) : Nerve leaving the vessel 1 cm above the superior pole

Type 2a

(20%) : Nerve leaving the vessel less than 1 cm above the superior pole

Type 2b

(20%) : Nerve leaving the vessel below the superior pole.

Clearly type 2b is at risk of iatrogenic injury.

So ligating the superior pride close to the upper pole is also not safe in 20% of cases. It appears that best way to prevent injury is to identify and preserve the nerve before ligating the pedicle.

But the anatomical facts are that nerve can be identified only in 80% of cases in the SLN triangle. Because in 20% of cases the nerve was located in the inferior constrictor muscle fibers as suggested by lennquists, cahlin and smeds.

Moreover the nerve in very thin and searching for the nerve is reported to have higher incidence of nerve paralysis. In goitrous enlargement the superior pole comes near the nerve and increasing risk of injury.

Prevention of SLN - Injury

The following approaches are recommended to prevent injury to SLN.

1. Not to search for the nerve.

2. Downward, outward and forward traction of upper pole before ligating the pedicle.

   This traction brings the pedide away from the nerve and prevents injury.

3. Ligating the branches of the superior thyroid artery.

The superior thyroid artery gives off 3 branches viz. one anterior and two posterior. These are especially prominent in large goitres. Ligating the vessel alone, blindly making sure no strand nerve is included prevents nerve injury.

Criothyroid muscle action

Frequency of vocal fold vibration is influenced by its tension. Tension depends on the vocal cord length. There are two muscles controlling it in opposing ways.

Length of Cord

Increased by : Cricothyroid muscle

Length decreased by : Thyroarytenoid muscle.

Hence the cord length (Tension) is a balance between these muscles.

Cricothyroid muscle has 2 bellies viz parsrecta and pars obliqua.

When these two portions contract the crico-thyroid cartilage distance is reduced lengthening the cord.

Diagnosis of SLN paralysis

* Clinically difficult as voice changes are subtle.

* Laryngascopicaly missed as changes in vocal cords are in consistent.

Features of cord in SLN palsy are,

1. Bowing of cord
2. Waviness of cord
3. Inferior and posterior displacement of affected vocal cord.

Most objective method of detecting an injury is EMG of (electromyography) cricothyroid muscle.

Incidence of SLN injury

Incidence of nerve injury varies according to the method of examination.

Lore reported 0.9% and Lennquists, cahlin, and smeds reported 2.6% injury based on laryngoscopic examination.

Janson reported a 58% injury rate using EMG as diagnostic tool.

Treatment

No effective therapy is available. Intensive phonotherapy is highly recommended. If the paralysis is permanent then career change is advised in voice professional.

Conclusion

Because of close and variable relation of SLN to superior pedicle it is recommended to ligate the pedicle close to the superior pole after appropriate traction.

HYPOPARATHYROIDISM

Paralythyroid insufficiency following thyroidectomy in due to

1. Removal of parathyroid glands in the thyroid specimen.

2. Devascularization of the gland.

Devascularisation of the gland is the most common cause for parathyroid insufficiency. The devascularization may be temporary or permanent based on the following factors.

1. Collateral blood supply from the paratracheal vessels.

2. Response of the remaining parathyroid glands to hypocalcemia.

3. Endothelia - 1, Entothelin 1 is an acute phase reactant which suppresses PTH release.

4. Hypothermia of parathyroid.

The problem of how many parathyroids must be preserved to maintain a normal serum calcium level remains unresolved. Parathyroid though 4 in number, each are unique. If one (or) two parathyroids are devascularised the remaining parathyroids either become hyperplastic and compensate (or) remain insufficient. This is the reason why hypocalcemia in seen evenafter hemithyroidectomy.

Hypoparathyroiddism is considered permanent when it doesn't improve after 6 months.

The incidence of temporary hypoparathyroidism is 25% and that of permanent is 0.5% (Bailey and Love)

Features of hypoparathyroid dism

The manifestations of hypoparathyroidism are due to hypocalcemia. Normal serum level, of calcium is 8-10 mg/dl. More than the total calcium levels the level of free calcium is important, as this is the biologically active one. Normally the level of free calcium is 50% of the total calcium. Remaining half is bound to albumim. Most common cause of hypoclacemia is hypoalbuminemia. In patients with hypoalbuminemia the absolute calcium level may be low but the patient is clinically normal.

The main effects of hypocalcemia are on the neurons and cardiac muscles. It increases the excitability of nerves.

Neurological effects: Early stages patients C/o. tingling and parathesia. Later stages proceeding to seizures and carpo-pedel spasms.

Chvosteks sign

Tapping over the branches of the facial nerve at the angle of the jaw with produce twitching at the angle of the month, the ala of the nose and the eyelids.

Trousseaus's sign

A sphygmomanometer cuff applied to the arm and inflated above the systolic blood pressure for not more than 2 minutes will produce carpal spasm.

ECG Changes

Prolonged ST segment due to delayed repolarisation of ventricles.

Management of Hypocalcemia

It usually manifest in the 2nd - 5th post-operative period. Its manifestations may be mild in the form of paraesthesia around lips and fingers tips (or) dramatic with carpo-pedal spasm and seizares. Screening for permanent hypoparathyroidism is done at 4-6 weeks by repeating Sr-calcium.

Emergency : 10ml of 10% calcium gluconte is given I.V. slowly over 10 minutes.

Maintenance : Calcium with vitamin D_3 oral supplements.

Prevention of hypoparathyoidism

1. Identification of parathyroids and preservation of blood supply.

2. If the gland is devascularised proceed to re-implantation.

Normally the vascularized parathyroids are yellow with varying quantity of brown tan. If devascualrised they turn greish. In such condition the gland must be cut to $1mm^2$ pieces,the minimal amount of tissue that can survive without blood supply, and implanted in sternomastoid muscle pockets and marked with non-absorbable sutures to facilitate easy identification, because primary hyper-parathyraidism has been reported in implanted tissue.

3. Examine the excised goitre specimen for parathyroid glands. If found must be re-implanted.

Points for identification of parathyroids

An individual parathyroid gland weights between 35-40 mg and measures 5 x 3 x 1 mm.

Parathyroid tissue can be identified and differentiated from other tissue by the following characteristics.

Structure	Colour	Firmness	Sliding movement	Vascular Hilum
1. Thyroid	Red	Yes	No	No
2. Fat	Yellow	No	No	No
3. Lymphnode	White with grey tan	Yes		No

4.	Thymus	White	No	No	No
5.	Parathyroid	Yellow with brown tan	Soft	Yes	Yes

Thus the parathyroids are identified by their colour, consistency, sliding movement on manipulation, also called as `rowboat riding on a wave' and by the presence of vascular hilum.

Site of parathyroids

Before the inferior thyroid artery is controlled 1st thing after "Medial dislocation of goiter" is identifying the RLN and second thing is identifying the parathyroids because parathyroid position is related to the RLN plane. Parathyroids position is related to embryological migration pathways.

Parathyroids relation to RLN has been described by pyrtec. If the RLN path is taken as a coronal plane, the inferior parathyroid is anterior to it and the superior parathyroid posterior.

Symmetry to parathyroid location in see on right and left sides. Finding the site of gland on one side must prompt us to look the opposite gland at the same corresponding site.

Superiors parathyroids

* Arises from the 4th pouch and travels with lateral analage/ C cell complex which forms the upper portion of the lateral thyroid lobes.

* More constant in location than the inferior glands.

* 80% of cases situated at level of cricothyroid joint.
* 20% of cases ectopic migrate posteriorly into posterior mediastinum.

Inferior parathyroids

* Arises from 3rd pouch along with thymus. It descend along with thymus. Its ectopic sites relate the direction of migration of thymus to the Anterior mediastinum.

* 40% of cases situated at lower pole of thyroid.

* 20% of cases in the thyrothymic ligament.

* 20% of cases Intrathymic (or) undescended lying withing the carotid sheath.

Protection of vascularity

Inferior parathyroids are supplied by the branches of the inferior thyroid artery. The superior parathyroid is supplied by the inferior thyroid artery and by the posterior branch of the superior thyroid artery.

Kocher originally performed ligation of inferior thyroid artery lateral to parathyroids. This devascularises the parathyroids and leaves then at the mercy of the paratracheal collaterals.

Halsted modified this manoeuver and suggested medial ligation of inferior thyroid branches dose to the capsule of the gland. This preserves the vasculature of the parathyroids.

Other causes of hypocalcemia

Other than hypoparathyroidism the following can cause hypocalcemia,

1. Calcitonin release

Manipulation of the goiter releases calatonin by C-cells. Calcitonin has got the opposite action on calcium hemostasis to PTH.

2. Hungry bone syndrome

This is seen in cases of thyroidectomies performed in toxicgoitres. In toxic goiter that hyperthyroidism causes demineralization of bones. When the goiters is removed the bone actively lays down bone matrix absorbing serum calcium producing hypocalcemia.

Hypoparathyroid hypocalcemia can be differentiated from above conditions by the concomitant rise in serum phosphorous level.

THYROTOXIC STORM

It is an acute exacerbation of hyperthyroidism. It occurs in a thyrotoxic patient who has been inadequately prepared for thryoidectomy. Now it is extremdyly rare. Very rarely a thyrotoxic patient may present with this crisis following an unrelated operation. Symptomatic and supportive treatment is for,

1. Dehydration
2. Hyperpyrexia
3. Restlessness
4. Cardiac failure and atrial fibrillation
5. Specific drugs
6. Hydrocortisone
7. Lugols iodine
8. Propranolal

WOUND INFECTION

It is not common may be seen in cases where a drainage tube is kept.

Hypertrophic (or) Keloid scar

It is more likely to form in neck. When suspected intra-dermal injections of corticosteroid should be given at once and repeated monthly if necessary.

MATERIALS AND METHODS

This is a prospective study conducted in our surgical unit at Stanley Medical College. The period of study is from March 2004 to October 2005.

Totally fifty four patients with varied clinical presentations were appropriately evaluated and operated.

The clinical details were entered onto a proforma specification, given in the following pages.

The data derived from the proforma was tabulated and anlaysed.

It is necessary to mention the study design.

I would like to mention the salient points which we make a routine in our surgical unit. This will enable us to interpret the data.

Mode of Admission

Patient with goiter presentation in our out-patient clinic were grouped as follows.

1. Diffuse goitre
2. Solitary nodule of thyroid
3. Multinodular goitre
4. Dominant nodule
5. Toxic Nodular goitre

This pattern of sub-division helps us to carry out the appropriate investigations.

Evaluation

The following are the routine investigation done other than the basis investigation.

1. FNAC
2. Thyroid profile
3. ENT evaluation for vocal cord status.
4. Serum calcium levels.
5. USG of thyroid is not routinely done.
6. Thyroid uptake study is done in
    1. Toxic nodular goitre
    2. Thyroglossal cyst
    3. Retrosternal goitre

Serum calcium levels are done to have a baseline value against which it can be compared in post -op for diagnosing cases of hypocalcemia.

Procedure

Only 3 basic types of surgery are done.

1. Hemi-thryoidectomy in solitary nodule of thyroid.

2. Total thyroidectomy in malignancy.

3. Sub-total thyroidectomy with either a monolateral remnant (or) bilateral remnant.

Sub-total thyroidectomy with bilateral (or) mono-lateral remnant is done in diffuse non-toxic and multinodular goitre.

Sub-total thyroidectomy with monolateral remnant is done in toxic nodular goiter.

Specific surgical techniques

Order in which the pedicle is ligated differs.

First always middle thyroid vein if present is ligated.

Next either the inferior thyroid vein (or) the superior pedicle is ligated. Superior pedicle is ligated, blindly, without searching for SLN, after gentle downward, outward and forward traction of the upper pole.

The goitre is medially rotated and RLN and parathyroid, are identified before controlling the inferior thyroid artery.

In most of the cases the parathyroid are identified and preserved before ligating the inferior thyroid vessels.

But in all cases RLN was identified and preserved before proceeding further.

The inferior thyroid was not ligated in toto, but its branches were ligated close to the level of thyroid capsule.

Wound was closed after keeping a corrugated rubber D.T.

Antibiotic prophylaxis

All patients were given a dose of 3rd generation cephalosporin 1 hour before surgery. The antibiotic was continued till the 3rd post operative day.

Post-operative care

- Drainage tube dressing is noted for soakage on the night of surgery. If excessive noted as post-op bleeding.
- Drainage tube is removed 24 hours after surgery if no active bleeding in noted.
- Symptoms of hypocalcemia are watched. When patient has the symptoms suggestive of hypocalcemia serum calcium done. IF the patient has hypocalcemia the sr. calcium repeated after 4-6 weekly as an OP procedure to rule out permanent hypocalcemia.
- Dressings are removed on the 3rd post-operative day and any wound infection noted.

Vocal cord function assessment

All patients were not subjected to routine post-OP assessment before discharge.

Vocal cord mobility is noted on the table as the anesthetist removes the endo-tracheal tube.

Patient with voice change are subjected to ENT evaluation.

Patient with vocal cord palsy are started on steroids and regularly followed up.

Vocal cord paralysis considered permanent if persistant for more than 6 months.

PROFORMA

Patients Name: Age: Sex:

I.P.NO.

Presentation

1. Solitary nodule
2. Diffuse goitre
3. Multinodular goitre
4. Dominant module

Investigations

FNAC

Thyroid profile

Serum calcium

ENT: Vocal cord status.

Type of procedure

1. Hemithyroidectomy

2. Sub-total thyroidectomy

3. Total thyroidectomy.

Post OP

- Hypocalcemia
- Bleeding
- Voice change
- Infection are noted.

Final Histopathology of Specimen Noted.

RESULTS

PATIENTS AGE

Breakup of patients age relation is as follows. Patients age varied from 2-68 years.

S.No	Age	Total out of 54	Percentage
1	20-30	20	3.7
2	30-40	17	31.4
3	40-50	10	18.5
4	50-60	6	11.1
5	60-70	1	1.8

Most of the disease is in the age group of 20-40 years.

PATIENTS SEX INCIDENCE

S.No	Sex	Total out of 54	Percentage
1	Male	6	11.1
2	Female	48	88.8

Thyroid disease is more common in females in the male female ratio of 1:8.

BREAKUP OF PATHOLOGY

All the various clinical presentation and their final histopathological outcome are anlaysed.

S.No	Type	Total out of 54	Percentage
1	SNG	26	48.1%

2	MNG	24	44.4%
3	Diffuse goitre	4	7.4%

Most common presentation is the solitary nodule followed by multinodular goiter.

SNG

In Solitary nodule thyroid incidence of various histological types is as follows,

S.No	Histopathology	Total out of 26	Percentage
1	Colloid cyst	17	65.3
2	Dominant nodule	4	15.3
3	Follicular Adenoma	4	5.3
4	Papillar carcinoma	1	3.8

Most common cause of solitary nodule is colloid cyst. Incidence of malignancy in SNG of thyroid is 3.8% Only one case of papillary carcinome is reported in the entire study.

4 out of 26 salitary nodule turn out to be dominant nodule of MNG.

MNG

Incidence of various histopathological types in multinodular goiter is tabulated as follows.

S.No	Type	Total out of 24	Percentage
1	True MNG	15	52.5
2	Thyroiditis	8	33.3
3	Colloid Goitre	1	4.1

Nearly one third of clinically appearing MNG has turned out to by thyroiditis.

It is interesting to note that not toxic case was operated. So the incidence of thyroid storm cannot be made out.

Overall Incidence of Hypocalcemia

S.No	Type	Total out of 54	Percentage
1	Transient	15	27%
2	Permanent	0	-

Incidence of Hypocalcemia in various procedures

S.No	Procedure	Total out of	Percentage
1	Hemi	4/25	16%
2	Sub-total	10/28	35%
3	Total	1/1	100%

Overall incidence of hypocalcemia is (15/54) 27.7%.

All of them are transient and none is permanent.

Incidene of hypocalcemia is more in more extensive surgery. Highest in total thyroidectomy

Incidence of hemorrhage

Overall incidence of haemorrage is (7/54) 12.9%.

S.No	Type	Total out of 54	Percentage

1	Per-OP	4	7.4
2	Post-Op	2	3.7
3	Both	1	1.8

Per OP bleeding was due to large goiters due to increased vascularity.

Incidence of voice change

Voice change was noted in 3 of 54 cases.

S.No	Type	Total out of 54	Percentage
1	RLN palsy	2	3.7%
2	SLN palsy	0	0%
3	Cord edema	1	1.8%

Two cases of cord paralysis was seen. The overall incidence of recurrent laryngeal N.palsy is 3.7%.

Of this only 1 showsed permanent paralysis bringing the incidence of permanent RLN paralysis to 1.8%.

Cord edema is supposed to be due to endotracheal intubation and it settled with steroids.

Incidence of wound infection

Wound infection was noted in 0 out of 54 cases. Bringing the incidence to 0%.

Incidence of scar hypertrophy

Scar hypertrophy was noted in 5 out of 54 cases. Bringing the incidence to 9.2%.

Since the surgery is performed in neck, due to constant stretching the scar in prone hypertrophy.

Incidence of SLN Palsy

Superior laryngeal nerve paralysis is not detected.

Sum up of complication rate in thyroidectomy:

S.No	Type	Incidence in %
1	Haemorrage	12.9
2	Hypocalcaemia	27.7
3	Voice change	5.5
4	Wound infection	0
5	Scar hypertrophy	9.2%

ANALYSIS

On analyzing the 54 cases operated upon the following observation are made.

- Most common complications is hypocalcemia 27.7%. All of which are transient only.
- Incidence of RLN palsy is 3.7%.
- Incidence of Permanent recurrent laryngeal nerve paralysis is 1.8%.
- Incidence of infection is 0%.
- Incidence of hemorrhage is 12.9%
- Most common presentation is solitary nodule of thyroid 48% percentage.
- Most of the disease is in the age group of 20-40 years.
- Females are most commonly affected, male : female ratio is 1:8.
- 1/3 of MNG turned out to be thyroiditis on final pathological report.

DISCUSSION

Key points are the parathyroids and recurrent laryngeal nerve.

It is surprising to note that the hypocalcemia is the most common complication (27.7%). It is slightly above the figure suggested by Bailey and Love (25%). The technique of medial ligation of inferior thyroid branches have paid off. Since it was not practiced in all cases, incidence of hypocalcemia may be further lowered by insisting the technique in all cases.

The incidence of RLN paralysis is 3.7%. Permanent palsy was within 1.8%. It was a bilateral injury to RLN. But still the patient managed to do without tracheostomy. Probably due to partial paralysis. The incidence quoted in book in 1-2%.

Superior laryngeal palsy was not found to be injured. This may reflect its subtleness in manifestation.

Use of USG in all MNG routinely may help reduce the incidence of thyroiditis being operated.

CONCLUSION

The study was undertaken in Government Stanley Medical Collage and Hospital on the incidence of complications in thyroid surgery. Following the study certain conclusion have been reached.

The incidence of permanent recurrent laryngeal nerve injury and hypocalcemia are within the acceptable limits.

Incidence of wound infection in zero.

BIBLIOGRAPHY

1. Bailey and Love short practice surgery. 24th Edition.

2. Sabiston Text book of surgery 17th edition.

3. Surgery of Thyroid and parathyroid by Randolbh.

4. Nhyhus mastery of surgery.

5. Recent advances in surgery 26th series.

6. Farquhaursons text book of operative surgery.

7. MC. Gregor. Applied anatomy.

8. Textbook of anatomy by Skandalakis.

9. Complications of thyroid surgery. World J. Surgery 28, 271-276, 2004.